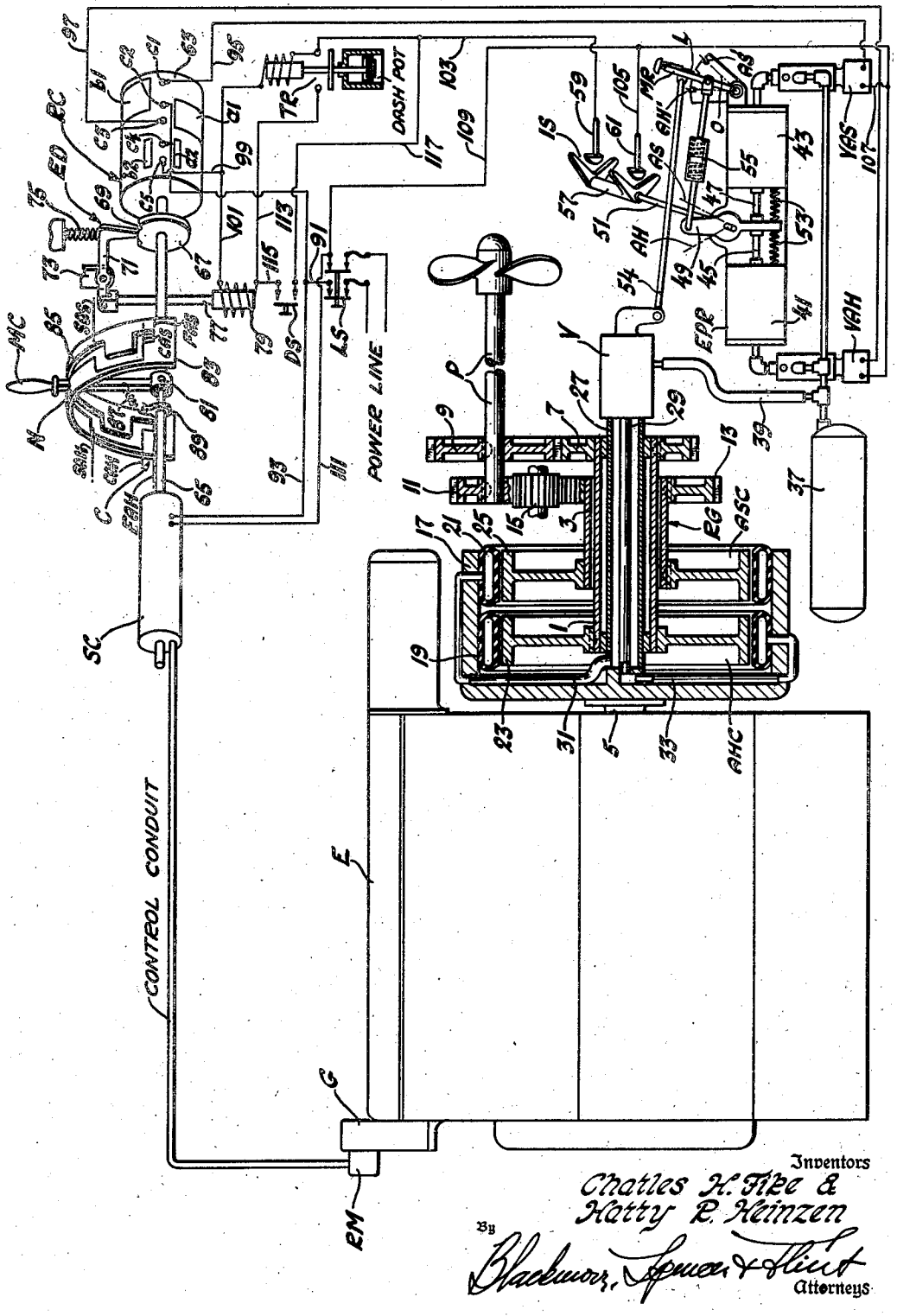
July 9, 1946. C. H. FIKE ET AL 2,403,647

SHIP DRIVE AND CONTROL SYSTEM

Filed July 3, 1943



Patented July 9, 1946

2,403,647

UNITED STATES PATENT OFFICE

2,403,647

SHIP DRIVE AND CONTROL SYSTEM

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Application July 3, 1943, Serial No. 493,336

10 Claims. (Cl. 192—.01)

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The present invention generally relates to ship drive and control systems and more particularly relates to systems of this type comprising a non-reversible engine, a reversing gear driven thereby, and control means for causing reversal of drive through the reversing gear and for varying the speed of the engine.

It is well known that in order to prevent stalling of the engine that ahead and astern driving connections should be established gradually before the engine speed is increased. Where the engine speed varying means and the reversing means are controlled by separate means care must be taken in operating each of these control means to obtain proper operation of the driving means. Heretofore, some attempts have been made to control the reversing means and the speed varying means in sequence by means of a single control lever but control systems of this type have not been found to be satisfactory, due to the expensive and complicated interlocking means used which were difficult to service and required frequent attention in order to obtain the proper sequence of operation required.

The principal object of the present invention is to provide a simple ship control system suitable for properly controlling the reversal of the reversing gear and the engine speed by manual movement of a single control lever between definite controlling positions determined by lever guiding and positioning means and by motion limiting means acting automatically in response to operation of the means controlled by the lever so that sequential and efficient operating characteristics of the ship driving means and proper maneuverability of the ship may be obtained without care on the part of an operator.

The control system by which the above object is obtained will become apparent by reference to the detailed description and single diagrammatic drawing showing our control system applied to a well known type of ship driving system comprising a non-reversible engine of the Diesel type and a reversing gear for driving a ship's propeller.

In the drawing the ship driving system includes a non-reversible Diesel engine E and a reversing gear RG for driving a ship's propeller shaft P.

The engine E is provided with a conventional speed responsive governor G having means, not shown, for varying the speed response thereof to cause the governor to control the fuel supplied to the engine in a well known manner necessary to cause operation of the engine at any one of a plurality of preselected values of constant speed.

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An electrical receiving motor RM of a well known type is operatively connected to the governor to cause adjustment of the speed response thereof. The receiving motor RM is electrically connected by means of control connections included in a control conduit to a well known type of transmitting speed controller SC so that the receiving motor is caused to follow certain movements of the transmitting controller.

The reversing gear RG includes a pair of hollow shafts 1 and 3 mounted in concentric relation in bearings, not shown, for rotation about an axis in alignment with the axis of the engine crankshaft 5. The rear end of the shaft 1 has a pinion gear 7 secured thereto which meshes with a gear 9 on the propeller shaft P and a gear 11, also secured on the propeller shaft, is operatively connected to a gear 13 secured on the shaft 3 by means of a counter shaft gear 15. Fluid pressure engaged ahead and astern clutching means shown generally at AHC and ASC, of a well known type, are included in the reversing gear to cause ahead or astern rotation of the propeller shaft P. This clutching means includes a common driving member or pulley 17 secured on the engine crankshaft 5 and having an internal cylindrical surface on which a pair of flexible and inflatable clutch tires 19 and 21 of annular form are secured in axially spaced relation. An ahead clutch driven member or pulley 23 is secured on the forward end of the shaft 1 of the reversing gear so that the external cylindrical surface of the pulley is engaged by the tire 19, upon inflation thereof, to cause ahead rotation of the propeller shaft P. An astern clutch driven member or pulley 25 is secured on the forward end of the other shaft 3 so that the external cylindrical surface of the pulley 25 is engaged by the tire 21, upon inflation thereof, to cause astern rotation of the propeller shaft P. Air pressure is supplied to or vented from the clutch tubes by means of a pair of rotary air tubes 27 and 29 shown extending through the hollow shaft 1 and secured to the hub of the driving member 17. The inner end of the rotary tube 27 is connected to the astern clutch tire 21 by a tube 31 and the inner end of the rotary tube 29 is connected to the ahead clutch tire 19 by a tube 33. Engagement and disengagement of the ahead or astern clutches is controlled in a well known manner by a combined seal and clutch control valve V, of a well known type, which is slidably supported on the outer ends of the rotary air tubes 27 and 29.

The clutch control valve V is connected to a pressure reservoir 37 by means of pipes and a flex-

ible hose 39 which permits sliding movement of the valve with respect to the rotary tubes 27 and 29. The rotary tubes and control valve are provided with suitable pressure and vent ports, not shown, in order to cause both of the clutch tires 19 and 21 to be vented to atmosphere to cause disengagement of both clutches when the valve is in the neutral position, as shown, and to cause inflation of either the tires to cause separate engagement of the clutches. The valve port arrangement is such that the ahead clutch tire 19 is inflated when the valve is moved forward of the neutral and the astern clutch tire 21 is inflated when the valve V is moved to the rear of the neutral position.

The clutch control valve V is movable between these positions by means of a well known type of electro-pneumatic reverser EPR or by a manually operable reversing lever MR which is pivotally mounted on the reverser. The reverser comprises opposed cylinders 41 and 43 containing pistons, not shown. The pistons are operably connected by piston rods 45 and 47 to an actuating lever 49 secured on a reverser rock shaft 51. Centering springs 53 are provided on the reverser to urge the actuating lever 49 to the vertical or neutral position, in which it is shown. Each of the reverser cylinders is shown connected to the pressure reservoir 37 by separate pipe connections, each of which includes an electro-pneumatic valve. These valves AHV and ASV are of a well known type which causes both of the reverser cylinders to be vented to atmosphere to cause the actuating lever to be returned to the neutral position when the electromagnetic windings of the valves are deenergized and upon energization of either of the windings to cause pressure to be applied to either cylinder in order to cause movement of the lever 49 to ahead or astern control positions AH or AS. Energization of the ahead valve VAH causes movement of the lever 49 to the ahead position AH and energization of the astern valve VAS causes movement of the lever 49 to the astern position. Energization and deenergization of these valves is controlled by a reversing controller RC which is operably connected to the speed controller SC. Both of these controllers are movable by a master control lever MC between a neutral position and slow, cruising and full speed ahead and astern controlling positions SAH, CAH, FAH, SAS, CAS and FAS. An interlocking switch, shown generally at IS, is operable by the reverser rock shaft 51 upon movement of the reverser actuating lever 49 to the ahead or astern position to control energization of a time delay relay TR which controls energization and release of electromagnetically releasable detent means ED for limiting movement of the controllers SC and RC. The detent means ED when deenergized permits movement of the master control lever between the slow speed ahead and astern controlling positions only, and upon release thereof, movement of the control lever to the higher speed controlling position is then permitted.

The manually operable reversing lever MR is connected by a link 54 to the clutch control valve V and is also connected by means of a resiliently extensible and compressible link 55 to the reverser actuating lever 49. The link 55 is compressible or extensible when the lever 49 is retained in the neutral position by the centering springs 53 and the manually operable reversing lever is moved from a neutral position, in which it is shown, to ahead or astern position AH' or AS' to cause movement of the clutch control valve V to positions causing inflation of either the ahead or astern clutch tubes 19 or 21 to cause ahead or astern drive of the propeller shaft P. The link 55 is also compressible or extensible upon movement of the reverser actuating lever 49 between the ahead or astern positions with the manually operable reversing lever held in the neutral, ahead or astern positions by latching means L provided on the lever MR, which is manually movable into slots in a lever quadrant O to prevent movement of the valve V by the reverser actuating lever 49. The latching means L is normally disengaged from the slots in the quadrant Q to allow movement of the lever MR and clutch control valve by the reverser actuating lever 49, in which case no compression or extension of the link 55 takes place.

The reverser interlocking switch IS includes a contactor member 57 secured to the reverser rock shaft 51 and a pair of stationary, flexible contact fingers 59 and 61 which are only bridged by fingers on the contact 57 when the actuating lever 49 moves to the ahead or astern positions AH or AS.

The time delay relay TR includes a relay winding, a pair of fixed contacts and an armature having a contact secured thereto and a dash pot connected to the armature in order to delay movement of the armature contact into bridging relation with the fixed contacts upon energization of the relay winding. The dash pot is adjusted to delay closure of the fixed contacts of the relay by the armature until either of the clutch tires 19 or 21 are inflated sufficiently to cause engagement of either the ahead or astern clutches AHC or ASC. Inflation of these tires takes place gradually to cause smooth clutch engagement. Energization of the time delay relay is controlled by closure of the interlocking switch IS through circuit connections, to be described, which are set up through the reverser controller RC.

The reverser controller includes stationary fixed contacts C1 to C5 and a drum 63 secured on a control shaft 65 which is directly connected to the transmitter speed controller SC. The controller drum 63 is provided with ahead contacts *a1* and *a2* and astern contacts *b1* and *b2*. The ahead drum contact *a1* is movable into bridging relation with the contacts C2 and C3 and the astern drum contact *b1* is movable into bridging relation with the contacts C1 and C2 to cause separate energization of the ahead or astern valves VAH or VAS of the reverser EPR when the master control lever MC is in any ahead or astern controlling position and the contacts C4 and C5 are bridged by either the ahead drum contact *a2* or the astern contact *b2* to set up electrical connections to the detent means ED only when the control lever MC is in the slow speed ahead or astern controlling positions. The master control lever MC is pivotally connected to the control shaft 65 and is movable in a slotted quadrant, in a manner to be described, whereby only step by step manual movement of the lever is permitted between the neutral position and the various ahead and astern speed controlling positions.

The detent means ED includes a detent flange 67 provided with a detent slot 69 and a detent lever 71. The detent flange 67 is secured on the control shaft 65 and the detent lever 71 pivoted to a stationary member 73. One end of the detent lever 71 is biased by a spring 75 into the de-

tent slot 69 and a plunger 77 provided with an electromagnet winding 79, is operably connected to the other end of the detent lever 71 to cause the release of the detent lever from the slot upon energization of the winding 79 by closure of the contacts of the time delay relay TR.

As previously mentioned, the master control lever MC is pivotally connected to the control shaft 65 by a pin 81 shown secured to and extending transversely with respect to the control shaft. A control lever quadrant 83 provided with a control lever slot 85 having slot portions extending parallel to the control shaft adjacent the neutral and ahead and astern lever controlling positions and off set slot portions extending transversely with respect to the control shaft between each of these controlling positions. The control lever MC is shown biased to the left in a neutral parking slot portion N of the quadrant 83 by means of a spring 87 connected between the lever and a collar 89 secured on the control shaft 65. It will be evident that with the quadrant slot portions arranged in this manner, the control lever MC must be rocked to the right or left about the pivot pin 81 on the control shaft 65 at each of these controlling positions before it can be moved angularly to another control position in order to cause angular movement of the control shaft 65 and operation of the controllers SC and RC.

The electrical control connections shown between the controllers and electrical means will now be described. Both controllers are shown connected across a power line when a double pole line switch indicated at LS is closed. One pole of this switch is connected by conductors 91 and 93 to one terminal of the transmitting controller SC and the stationary contacts C2 and C4 of the reverser controller RC. The stationary contact C1 of the controller RC is connected by a conductor 95 to one winding terminal of the astern electro-pneumatic valve VAS of the reverser EPR and the stationary controller contact *c3* is connected by a conductor 97 to one winding terminal of the ahead electro-magnetic valve VAH. The stationary contact *c5* is connected to one terminal of the winding 79 of the electro-magnetic detent means ED and one winding terminal of the time delay relay TR by conductors 99 and 101. The opposite winding terminal of the relay winding and one fixed relay contact are connected by a conductor 103 to the flexible contact finger 59 of the interlocking switch IS and the other flexible contact finger 61 of this switch and the other winding terminals of the valves VAH and VAS and also the other terminal of the speed controller SC are connected by conductors 105, 107, 109 and 111 to the opposite pole of the line switch IS. The opposite terminal of the winding 79 of the detent means is connected to the other fixed relay contact by a conductor 113 which is connected by a conductor 115 to one pole of a double pole manually operable energizing detent release switch DS, the other pole of which is connected to the conductor 103 by a conductor 117.

With the various control means in their normal positions, as shown, the operation of the drive and control system is as follows:

Slow speed ahead drive is obtained when the engine is running at idling speed by first rocking the master control lever MC to the right out of the neutral quadrant slot portion N and then moving it angularly counterclockwise to the slow speed ahead position SAH which causes the control shaft 65 and transmitting speed controller SC and drum 63 of the reverser controller RC to be moved counterclockwise until the stationary controller contacts *c2* and *c3* are bridged by the ahead drum contact *a1* of the reversing controller RC and the stationary contacts *c4* and *c5* are bridged by the ahead drum contact *a2*. The detent means ED prevents further counterclockwise movement of the control shaft. As previously mentioned, this limited movement of the transmitter controller SC is insufficient to cause energization and follow-up movement of the receiver motor RM and the engine continues to operate at idling speed. The bridging of the stationary contacts *c2* and *c3* of the reversing controller completes an energizing circuit to the ahead electro-pneumatic valve VAH through the conductors 91, 93, 97 and 109 to cause air pressure from the reservoir 37 to enter the cylinder 41 of the reverser EPR and cause movement of the actuating lever 49 to the ahead control position AH. Movement of the actuating lever 49 to this position moves the manual reversing lever MR to the ahead position AH' and moves the clutch control valve V forward of the neutral position by means of the links 54 and 55, therebetween, and rotates the rock shaft 51 to cause closure of the interlocking switch IS. Movement of the valve V to this position causes air from the reservoir 37 to enter the ahead clutch tire 19 of the reversing gear RG through hose 39, rotary tube 29 and connecting tube 33 which causes smooth engagement of the ahead clutch AHC. The closure of the interlocking switch IS completes an energizing circuit to the winding of the time delay relay TR through the then bridged stationary contacts *c4* and *c5* of the reversing controller RC and conductors 91, 93, 99, 101, 103, 105 and 109 to cause upward movement of the relay armature by the winding against the retarding action of the dash pot on the armature. The dash pot, as previously explained, is adjusted to delay closure of the relay contacts until the ahead driving clutch tire 19 is inflated sufficiently to cause engagement of the ahead clutch AHC which causes the propeller shaft P to be driven at slow speed in the ahead direction by the engine through the shaft 1 and gears 7 and 9 interconnecting the shaft 1 with the propeller shaft P. Closure of the contacts of the time delay relay TR completes a circuit to the detent winding 79 through conductors 101, 113 and 103 and through the closed interlocking switch IS and conductors 105 and 109, which causes the release of the detent means ED. Release of the detent means allows the master control lever MC to then be angularly moved to the ahead cruising speed position CAH after rocking the lever to the left in the slow speed ahead position SAH. Movement of the lever MC to the ahead cruising speed position causes further angular movement of the control shaft 65 and controllers SC and RC. This further movement of the transmitting controller SC causes energization and follow-up movement of the receiving motor RM thereby causing sufficient adjustment of the speed response of the engine governor GOV to cause an increase in the speed of the engine from the idle value to the cruising speed value. This further counterclockwise angular movement of the reversing controller drum 63 causes the ahead drum contact *a2* to be moved out of contact with the contacts *c4* and *c5* which causes simultaneous deenergization of the winding of the detent means ED and the winding of the time delay relay. Deenergization of the

winding of the detent means causes the spring 75 to move the detent lever 71 back into engagement with the detent flange at a point adjacent the detent slot 69, and deenergization of the winding of the time delay relay TR causes the contacts thereof to open.

In order to obtain full speed ahead drive the control lever MC is first rocked to the right in the ahead cruising position CAH to permit counterclockwise movement of the lever to the full speed ahead position FAH which causes further angular movement of the controllers SC and RC. This further movement of the transmitting controller SC causes additional follow-up movement of the receiving motor RM and a further change in the governor speed response necessary to cause an increase in the engine speed to the full speed value. The ahead drum contact *a1* is of sufficient angular length to continuously bridge the contacts *c2* and *c3* of the reversing controller RC when the lever is moved between the slow speed and full speed ahead positions in order to keep the ahead electromagnetic valve VAH of the reverser energized and the actuating lever 49 in the ahead controlling position AH thereby holding the clutch control valve in a position to keep the ahead clutch tube 19 inflated and ahead clutch CAH engaged.

With the master control lever MC in the full speed ahead position FAH in order to cause reversal of drive the lever is rocked and moved clockwise angularly from the full speed ahead position FAH to the slow speed astern position SAS where the detent means ED prevents further movement of the lever until the engine speed is reduced to the idle value and the ahead clutch is disengaged before engagement of the astern clutch takes place which then causes release of the detent means to permit further clockwise step by step movement of the control lever successively to the astern cruising and full speed positions CAS and FAS from the slow speed astern position SAS by rocking movement of the control lever at each of these astern positions. It will be evident that when the control lever is rocked and moved clockwise past the slow speed ahead position as quickly as possible the contact *c4* and *c5* of the reversing controller will be momentarily bridged by the ahead drum contact *a2* and then both of the ahead drum contacts *a1* and *a2* will be moved out of bridging relation with the contacts *c2*, *c3*, *c4* and *c5*. The momentary bridging of the contacts *c4* and *c5* causes momentary energization of the winding of the time delay relay TR but the relay contacts do not close in time to cause energization of the winding of the detent means ED and therefore the spring 75 on the detent lever 71 causes one end of the lever to enter the detent slot in the flange 67 when the control lever MC is moved clockwise away from the slow speed ahead position. The opening of the contacts *c2* and *c3* of the controller RC by clockwise movement of the control lever MC from the slow speed ahead position SAH causes deenergization of the ahead electro-pneumatic valve VAH to cause venting of the reverser cylinder 41 which causes the return of the reverser actuating lever 49, reversing lever MR and clutch control valve V to the neutral positions by the action of the reverser centering springs 53. When the valve is returned to the neutral position the ahead clutch tire 19 is vented to cause disengagement of the ahead clutch AHC. The clockwise movement of the control lever MC to the slow speed astern position SAS, where further angular movement is stopped by the detent means ED, causes the contacts *c1* and *c2* of the reverser controller RC to be bridged by the astern drum contact *b1* and the contacts *c4* and *c5* to be bridged by the astern drum contact *b2*. The bridging of the contacts *c1* and *c2* completes an energizing circuit to the astern electro-pneumatic valve VAS through these contacts and conductors 91, 93, 95, 107 and 109 to cause air pressure to enter the reverser cylinder 43 and cause movement of the reverser actuating lever 49, the reversing lever MR and the clutch control valve V from the neutral position to astern position which causes inflation of the astern clutch tire 21 and smooth engagement of the astern clutch ASC as the engine is now operating again at idling speed. The bridging of the contacts *c4* and *c5* by the astern contact *b2* of the reverser controller causes energization of the winding of the time delay relay TR through the same circuit connections as previously described which causes delayed closure of the relay contacts. Closure of the relay contacts again causes energization of the winding 79 of the detent means ED through the bridged contacts *c4* and *c5* and the same circuit connections as previously described to cause release of the detent means to allow further clockwise movement of the control lever MC successively in steps to the cruising and full speed astern positions from the slow speed astern position by rocking movement of the control lever at each of these control positions. It will be evident that the engine speed is increased by clockwise movement of the controller to the astern cruising and full speed positions and the detent lever 71 is caused to reengage the detent flange 67 to allow counterclockwise movement of the control lever only from the astern cruising and full speed positions to the slow speed ahead control position in the reverse manner to that described above to cause a reduction in the engine speed to the idle value and disengagement of the astern clutch ASC before engagement of the ahead clutch AHC is permitted.

The manually operable emergency detent release switch DS is provided to cause release of the detent means ED should the time delay contacts fail to close. It will be evident that when this emergency switch is closed a circuit is completed to the winding 79 of the detent means ED through the bridged contacts 59 and 61 of the interlocking switch IS and the bridged contacts *c4* and *c5* of the reverser controller and conductors 91, 93, 99, 101, 115, 117, 103, 105 and 109 to permit emergency release of the detent means.

The manually operable reversing lever MR is provided to move the clutch control valve V directly in order to cause engagement of either clutch independently of the reverser EPR and to also prevent movement of the valve V by the reverser in response to controlling movement master control lever MR when the latch L on the reversing lever is manually engaged in any of the control positions, the notches of the reversing lever quadrant O adjacent the neutral or ahead or astern positions AH' or AS'.

It will be evident that the above control system provides smooth engagement of either of the ahead or astern clutches after which the engine speed may then be increased above the idle value in response to certain movements of a single manually operable control lever which is limited to step by step movement between definite control positions and prevented from be-

ing improperly moved by detent means releasable in response to means controlled by the lever so that no skill is required on the part of the operator to obtain proper and efficient variable speed and reverse operation of the ship driving means.

We claim:

1. A ship drive and control system comprising an engine, speed controlling means therefor, electrical actuating means for said speed varying means, a reversing gear driven by said engine, electro-pneumatic reversing means for said reversing gear, movable electrical control means for controlling said electrical actuating means and said electro-pneumatic reversing means, a manually operable control lever for said control means movable between a neutral control position and a low and high speed reversing control position to cause corresponding operation of said engine and reversing gear, detent means for limiting the movement of said control means to cause low speed operation of said engine or low speed reverse drive of said reversing gear by said engine, electrical detent releasing means to permit further movement of said control means by said lever to cause reverse drive of said reversing gear by said engine at higher values of engine operating speed, a time delay relay for controlling said electrical detent releasing means, and control means for said time delay relay operably connected to said electro-pneumatic reverser to cause release of said detent means only upon reversal of said reversing gear.

2. A ship and control system comprising an engine, speed controlling means therefor, electrically controlled means for actuating said speed controlling means, a reversing gear driven by said engine having pressure engaged ahead and astern clutches, valve means for controlling said clutches to cause reversal of drive through said reversing gear, electrically controlled actuating means for said valve means, electrical control means for both of said electrically controlled actuating means, a manually operable master control lever for said control means, said lever being movable between a neutral idling speed position and low, cruising and full speed ahead or astern controlling positions for operating said electrical control means, detent means for limiting movement of said lever between the low speed ahead and astern controlling positions, a lever quadrant having angularly extending slotted portions for limiting controlling movement of the lever in steps between the controlling positions, and delayed action electrical detent releasing means operably connected with and controlled by said valve actuating means upon actuation thereof, to cause engagement of either clutch of said reversing gear.

3. A ship drive and control system comprising an engine, speed regulating means therefor, electrically controlled actuating means for said speed regulating means, a reversing gear having fluid engaged ahead and astern driving clutches driven by said engine, valve means for controlling separate engagement and simultaneous disengagement of said clutches, electrically controlled actuating means for operating said valve to prevent drive or permit ahead or astern drive through said reversing gear, a propeller shaft driven by said reversing gear and remote control means for said electrically controlled engine and reversing gear means, said control means comprising a single master control lever, a quadrant for said lever having angularly disposed slotted portions for limiting and controlling movement of the lever in steps between a neutral clutch disengaged controlling position and low, cruising and full engine speed ahead or astern clutch engaged controlling positions, means for retaining said lever in engagement with said quadrant slotted portions and electrical control means operable by said lever for controlling said electrically controlled actuating means for said engine and reversing gear to cause operation thereof corresponding to movement of said master control lever between the lever controlling positions.

4. A ship drive and control system comprising an engine, speed regulating means therefor, electrical actuating means for said speed regulating means, a reversing gear having fluid pressure engaged ahead and astern driving clutches driven by said engine, a clutch control valve for controlling separate engagement of said clutches, electrically controlled valve actuating means, a propeller shaft driven by said engine through said reversing gear, control means for said electrically controlled actuating means for said engine and said clutch control valve, said control means being located remotely with respect to said engine and gear and comprising electrical controller means, a master control lever operably connected thereto, motion limiting and controlling means for said lever and controller means comprising a lever quadrant having angularly disposed slotted portions for limiting movement of said lever in steps between a neutral non-driving controlling position and low, cruising and full speed ahead or astern driving controlling positions, detent means normally preventing movement of said lever beyond said low speed ahead or astern controlling positions, electrically actuated detent releasing means, a time delay relay for controlling said electrically actuated detent releasing means and a switch for controlling said time delay relay, said switch being operably connected to said electrically controlled actuating means for said clutch control valve to cause operation of said relay only upon full engagement of either of said clutches.

5. A ship drive and control system comprising an engine, speed varying means therefor, actuating means for said speed varying means, a reversing gear driven by said engine, actuating means for causing reversal of said gear, a propeller shaft driven by said gear, movable control means for both of said actuating means, releasable motion limiting means for said control means for normally limiting controlling movement thereof to initially cause reversal of said reversing gear and releasable to permit further controlling movement of said control means thereby to cause an increase in the engine speed, delayed action means for controlling the release of said releasable motion limiting means, control means operable only by actuation of said actuating means causing reversal of said gear for controlling said delayed action means, a manually operable control lever for operating said first mentioned control means, a quadrant for said lever having slotted portions angularly disposed and constituting motion limiting and retarding means for said lever so that further and proper controlling movement thereof is permitted only upon the release of said releasable motion limiting means, whereby the actuating means for said engine speed varying means causes the speed of the engine to be properly increased between slow and full speed values, and emergency manually operable means for controlling the release of said re-

leasable motion limiting means independently of said delayed action means.

6. A ship drive and control system comprising a non-reversible engine, a governor driven by the engine, means for varying the speed response of the governor to cause operation of the engine at any one of a plurality of constant values of speed, a reversing gear driven by the engine including pneumatically engaged ahead and astern driving clutches, valve means for causing disengagement of both clutches and engagement of either, means for operating said valve, said valve operating means comprising a manual reversing lever operably connected to said valve, and a power operated reverser and a resiliently extensible and compressible link connected between said lever and said reverser to cause operation of said valve and lever by said reverser or to permit operation of said valve by said lever independently of said reverser, manually operable means for preventing movement of said reversing lever, control means for said governor speed response varying means and said reverser, said control means including a master control lever, a lever quadrant having off set slotted portions to limit movement of the lever in steps between neutral, slow, cruising and full speed ahead and astern controlling positions to cause corresponding operation of the engine and reversing gear, detent means for permitting movement of said master control lever only between neutral and slow speed ahead and astern positions, actuating means for causing release of said detent means, control means for causing actuation of said detent actuating means, said last named control means comprising time delay means, control means for said time delay means operable by said reverser, and separate manually operable emergency control means for said detent actuating means.

7. A ship drive and control system comprising an engine, speed varying means therefor, actuating means for said speed varying means, a reversing gear driven by said engine and including forward and reverse driving clutches of the slow engaging type, clutch engaging means for causing engagement of either of said clutches, manual control means for controlling both the speed varying means and clutch engaging means, releasable motion limiting means for said manual control means normally limiting movement of said control means to cause operation of said clutch engaging means to cause slow engagement of either clutch, said releasable motion limiting means being releasable to permit further movement of said control means in order to control operation of said engine speed varying means, time delay means for controlling the release of said releasable motion limiting means, and control connections between said clutch engaging means and said time delay means to delay release of said releasable motion limiting means until full engagement of either of said clutches occurs in order to then permit a variation in the engine speed by further movement of said control means.

8. A ship drive and control system comprising an engine having power operated speed varying means, a reversing gear driven by said engine having pressure operated ahead and astern driving clutches, power operated means for controlling the application of pressure to and the release of pressure from either of said clutches, a manually movable master controller for controlling operation of both of said power operated means, releasable motion limiting means for said master controller normally limiting movement thereof necessary to cause application of pressure to either clutch and release of pressure from both and releasable to then permit further movement of said master controller to control said power operated engine speed varying means in order to then raise the engine speed to the maximum value, time delay control means for controlling the release of said releasable motion limiting means, said time delay means being connected to said pressure application and release means for said clutches for delaying the release of said releasable motion limiting means until the pressure applied to either clutch causes full engagement thereof.

9. A ship drive and control system comprising an engine having power operated speed varying means, a reversing gear driven by said engine and including fluid pressure engaged ahead and astern driving clutches, a power operated clutch control valve means for controlling the application of pressure to either of said clutches and the release of pressure from both clutches, a master control lever movable for controlling said power operated engine speed varying means and clutch valve, releasable motion limiting means for said lever normally permitting movement thereof to control said power operated control valve and releasable to then permit further movement of said lever to control said power operated speed varying means, time delay control means for controlling the release of said releasable motion limiting means, said time delay means being connected to said power operated clutch control valve to cause the release of said releasable motion limiting means after the pressure applied to either clutch causes full engagement thereof, and manual emergency means for controlling the release of said releasable motion limiting means independently of said time delay means.

10. A ship drive and control system comprising an engine having power operated speed varying means, a reversing gear driven by said engine and having pressure expansible and engageable ahead and astern driving clutches, a power operated valve for controlling application of pressure to either of said clutches and release of pressure from both clutches, a master control lever movable to control said power operated means, releasable motion limiting means normally limiting movement of said lever to control said power operated valve to cause ahead or astern drive and releasable to permit further movement of said lever to cause proper variation in the engine speed, means for retarding and interrupting further movement of the lever upon release of said releasable motion limiting means to cause proper changes in the engine speed, time delay means for normally controlling the release of said releasable motion limiting means, said time delay means being connected to said power operated control valve so that it normally delays release of said releasable motion limiting means until either of said clutches is fully expanded and engaged by application of pressure thereto, and emergency manually operable means for controlling the release of said releasable motion limiting means independently of said time delay means.

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